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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/707,892	01/21/2004	Tien-Jen Cheng	FIS920030352US1	1891
32074	7590	08/10/2006	EXAMINER	
INTERNATIONAL BUSINESS MACHINES CORPORATION			LANDAU, MATTHEW C	
DEPT. 18G			ART UNIT	
BLDG. 300-482			2815	
2070 ROUTE 52			PAPER NUMBER	
HOPEWELL JUNCTION, NY 12533			DATE MAILED: 08/10/2006	

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.		Applicant(s)	
	10/707,892		CHENG ET AL.	
	Examiner		Art Unit	
	Matthew Landau		2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 May 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-5, 7-14 and 21-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-5, 7-14 and 21-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 January 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION***Drawings***

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the hard test barrier on and enclosing said conductive layer pad, along with a terminal metal layer (claims 1 and 8), must be shown or the feature(s) canceled from the claim(s). Furthermore, the copper seed layer pad on and enclosing said diffusion barrier layer (claim 21), must be shown or the feature(s) canceled from the claim(s). Note that Figures 3F and 3G do not show a terminal metal layer. No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

Claim 12 is objected to because of the following informalities: the limitation “extends” should be changed to “extending”, or the claim should otherwise be amended to correct the grammatical error. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 21-25 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The limitation “a copper seed layer pad on, and enclosing, said diffusion barrier layer” is not sufficiently supported by the originally filed application. The drawings and specification do not show or discuss a copper seed layer enclosing a diffusion barrier layer (in conjunction with the other claim limitations). Therefore, the above limitation constitutes new matter.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-5 and 7 are rejected under 35 U.S.C. 102(e) as being anticipated by Cheng et al. (US PGPub 2005/0103636, hereinafter Cheng).

The applied reference has a common assignee/inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention “by another,” or by an appropriate showing under 37 CFR 1.131.

Regarding claims 1, 5, and 7, Figure 6 of Cheng discloses a terminal metal layer 106/102 disposed on a passivating layer 108/110; a diffusion barrier layer (116 and the CrCu portion of 118) on said terminal metal layer; a conducting layer pad (Cu portion of 118) on said diffusion barrier; a hard test barrier layer (Ni) 122 (paragraph [0014]) on, and enclosing, said conducting layer pad; and a plate passivating layer (Au) 124 (paragraph [0014]) on said hard test barrier. Note that Cheng discloses layer 118 can be a multi-layered structure of Cu/CrCu (paragraph

Art Unit: 2815

[0013]). Therefore, the Cu layer is considered to be the conducting layer pad, and the CrCu layer is considered to be part of the diffusion layer.

Regarding claims 2-4, Figure 6 of Cheng discloses said diffusion barrier layer includes an adhesion layer (TiW) 116 (paragraph [0013]) on barrier metallurgy (CrCu portion of 118).

Claims 1, 2, 5, and 7 are rejected under 35 U.S.C. 102(e) as being anticipated by Biggs et al. (US PGPub 2005/0062170, hereinafter Biggs).

The applied reference has a common assignee/inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

Regarding claims 1, 5, and 7, Figure 6 of Biggs discloses a terminal metal layer 16/18 disposed on a passivating layer 12/14; a diffusion barrier layer 36 on said terminal metal layer; a conducting layer pad 38 on said diffusion barrier; a hard test barrier layer (Ni) 48 (paragraph [0012]) on, and enclosing, said conducting layer pad; and a plate passivating layer (Au) 50 (paragraph [0012]) on said hard test barrier.

Regarding claim 2, Biggs discloses layer 36 consists of a layer of Ta and a layer of TaN (paragraph [0008]). The Ta layer can be considered the adhesion layer and the TaN layer can be considered the barrier metallurgy.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 5, and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe et al. (US Pat. 6,614,113, hereinafter Watanabe) in view of McCormick (US Pat. 6,706,622).

Regarding claims 1, 5, 7, and 8, Figure 3 of Watanabe discloses an IC chip 2 having a chip pad comprising: a terminal metal layer 5 disposed on a passivating layer 6 and connecting to underlying chip wiring through a via through said chip passivating layer; a diffusion barrier layer (adhesion/barrier layer) 31 on said terminal metal layer; a conducting layer pad (seed pad) 32 on said diffusion barrier; and a hard test barrier layer (Ni) 33A (col. 5, lines 1-3) on, and enclosing, said conducting layer pad. Note that layer 31 is made of titanium (col. 4, lines 39-41). Since titanium functions as both a barrier layer and an adhesion layer, layer 31 can be considered an adhesion/barrier layer as claimed. The difference between Watanabe and the claimed invention is a plate passivating layer (of Au) on said hard test barrier layer. Figure 6 of McCormick discloses a bonding pad with a gold passivating layer 30 over a nickel layer 26. In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Watanabe by including a gold layer above the hard test barrier 33A for the

Art Unit: 2815

purpose of inhibiting oxidation of the nickel layer (col. 3, lines 41-43 of McCormick)).

Regarding claim 8, it would have been further obvious to modify Watanabe to have more than one pad as taught by McCormick (Figure 6) for the purpose of allowing separate electrical connections to different portions of the IC. Note that the limitation "plated" is merely a product-by-process limitation that does not structurally distinguish the claimed invention over the prior art of record.

Claims 2-4 and 9-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe in view of McCormick as applied to claims 1 and 8 above, and further in view of Degani et al. (US Pat. 6,232,212, hereinafter Degani).

Regarding claims 2-4, 9, and 10, Figure 3 of Watanabe discloses layer 31 is made of titanium (col. 4, lines 39-41). A further difference between Watanabe and the claimed invention is the diffusion (adhesion/barrier) layer includes an adhesion layer on barrier metallurgy. Figure 9 of Degani discloses CrCu layer 22 on a Ti layer 21 (col. 3, lines 41-50). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Watanabe by including a CrCu layer between the Ti layer 31 and the Cu layer 32 (col. 4, lines 54-56). The ordinary artisan would have been motivated to modify Watanabe in the manner described above for the purpose of providing a solder wettable and metallurgically sound interface between the titanium layer and the subsequently formed copper layer (col. 3, lines 47-50 of Degani). Note that the Ti layer is the barrier metallurgy and the CrCu layer is the adhesion layer.

Art Unit: 2815

Regarding claim 11, Watanbe discloses the seed pad 32 comprises a copper pad (col. 4, lines 54-56).

Regarding claim 12, Figure 3 of Watanabe discloses the hard test barrier layer 33A comprises a nickel layer (col. 5, lines 1-3) plated to and extends along the sides of said copper pad 32. Note that the limitation “plated” is merely a product-by-process limitation that does not structurally distinguish the claimed invention over the prior art of record.

Regarding claim 13, after the above combination (for the rejection of claim 8), the plate passivating layer is made of Au as taught by McCormick.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe in view of McCormick and Degani as applied to claim 13 above, and further in view of Homma and Bhattacharya et al. (US PGPub 2003/0034489, hereinafter Bhatt).

Regarding claim 14, semiconductor IC chips are fabricated from a wafer of semiconductor material, and the wafer is not diced into individual chips until after the ICs have been completed. Therefore, in order to make the device of Watanabe, there must have been a plurality of IC chips on a wafer at an intermediate stage of processing. However, Watanabe does not explicitly disclose that the wafer is diced into individual IC chips after forming the claimed metal layers on the IC chip substrate. Figures 9A-9E of Homma discloses forming a plurality of metal layers on a wafer prior to dicing the wafer into individual chips (col. 11, lines 38-41). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Watanabe by dicing the wafer after

Art Unit: 2815

forming the claimed metal layers, thereby resulting in a plurality of ICs (with the claimed structure) on a wafer. The ordinary artisan would have been motivated to further modify Watanabe in the manner described above for the purpose of simply the production process for mass production. A further difference between Watanabe and the claimed invention is the ICs are identical. Bhatt discloses forming a plurality of identical ICs on a wafer (paragraph [0030]). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Watanabe by having a plurality of identical ICs on a wafer for the purpose of simplifying the production process for mass production of a particular IC. Note that paragraph [0003] of the instant application gives a special definition to the word “die” by stating “Each array location is known as a die and each die may harbor an IC chip”. In other words, a “die” is simply the portion of the wafer where the chip is located. Therefore, it is inherent that each of said plurality of identical ICs are located in a die on said wafer.

Claims 21 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over McCormick in view of Degani.

Regarding claims 21 and 25, Figure 6 of McCormick discloses a chip pad comprising: a passivating layer 12; a diffusion barrier layer 16; a copper seed layer 18 on, and enclosing, said diffusion barrier layer; a nickel layer 26 (col. 3, lines 31-33) plated to said copper seed layer pad; and a plate passivating layer (Au) (col. 3, lines 39-41) on said nickel layer. Note that it can be considered that the copper layer 18 encloses layer 16 since it covers the only exposed surface of

Art Unit: 2815

the layer. The difference between McCormick and the claimed invention is a terminal metal layer disposed on the passivating layer. Figures 1 and 9 of Degani discloses an aluminum terminal metal 13 on a passivating film 12, below a diffusion barrier layer 21/22. In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of McCormick by including the aluminum terminal layer of Degani for the purpose of further protecting the underlying circuitry during bonding, while maintaining a low resistance contact.

Regarding claims 22-24, it would have been further obvious to modify McCormick by using the diffusion barrier layer 21/22 of Degani, which comprises a Ti barrier layer 21 and a CrCu adhesion layer 22 (col. 3, lines 40-50 of Degani) for the purpose of providing a well known barrier material and improving adhesion between the terminal metal layer and the overlying copper seed layer.

Response to Arguments

Applicant's arguments with respect to the pending claims have been considered but are moot in view of the new ground(s) of rejection.

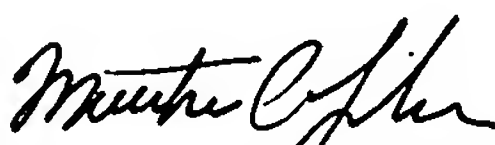
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew C. Landau whose telephone number is (571) 272-1731.

Art Unit: 2815

The examiner can normally be reached from 8:30 AM - 5:30 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Parker can be reached on (571) 272-2298. The fax phone numbers for the organization where this application or proceeding is assigned are (571) 273-8300 for regular communications and (571) 273-8300 for After Final communications.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should any questions arise regarding access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Matthew C. Landau

August 6, 2006